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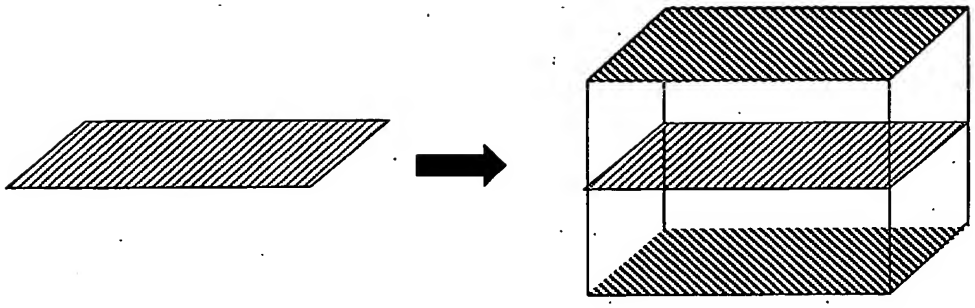

Figure 1

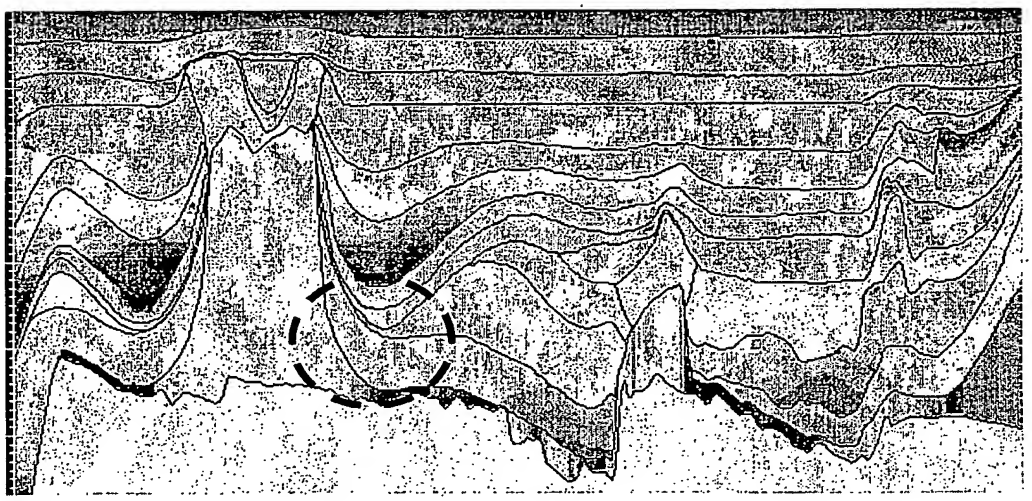

Figure 2

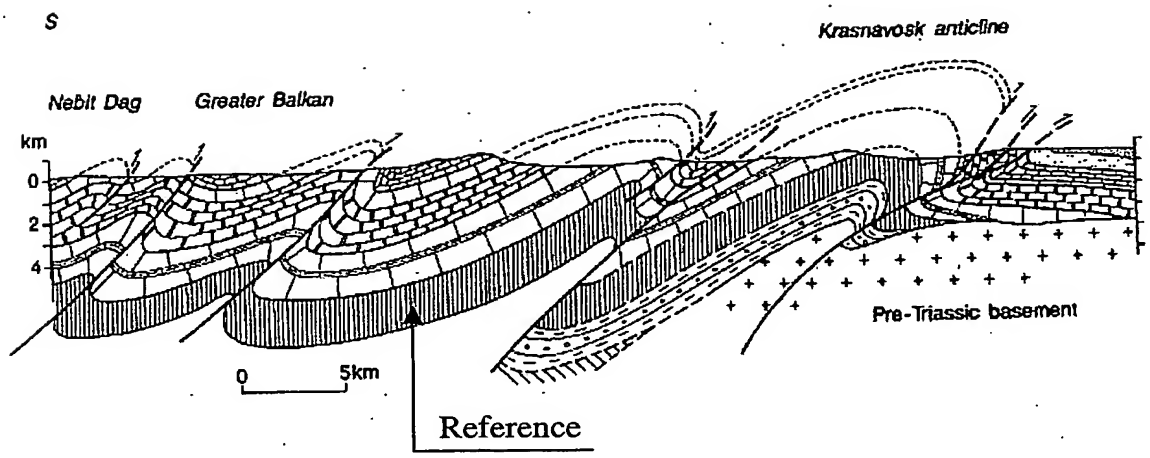

Figure 3

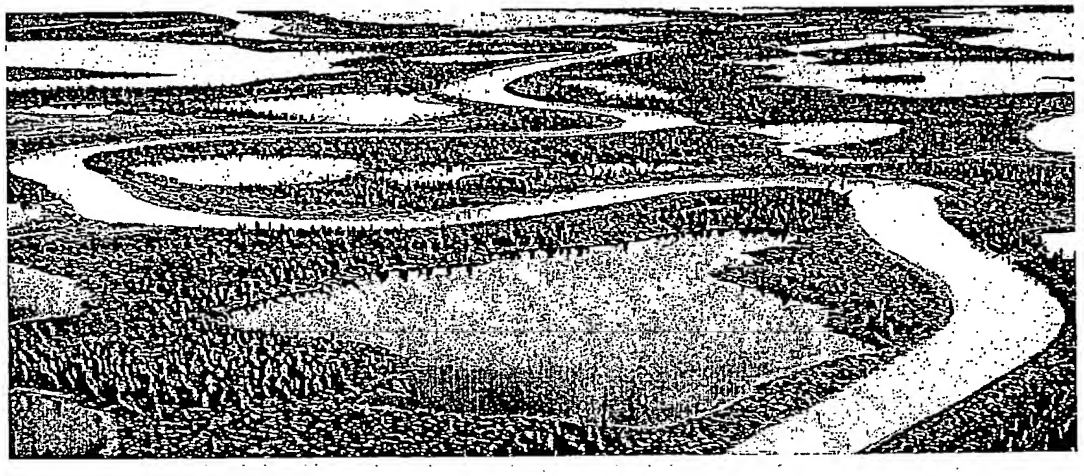

Figure 4

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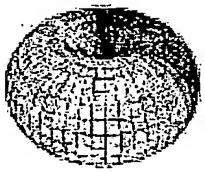
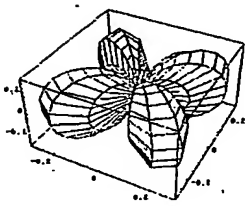
Y_{00}

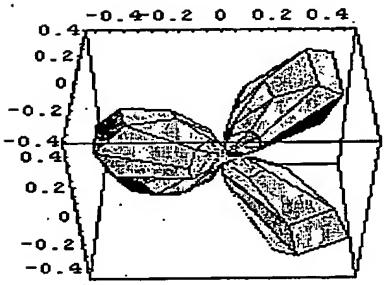


Y_{01}

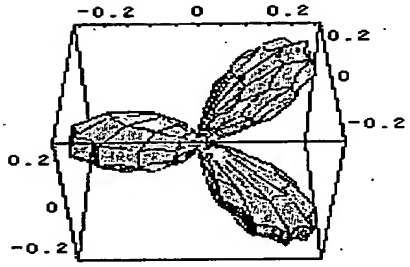


$Re(Y_{21})$

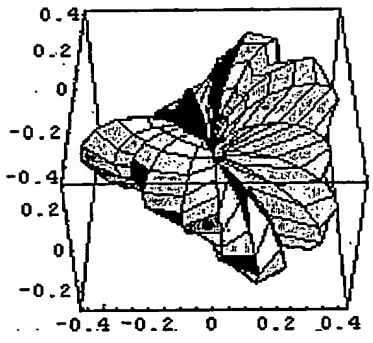
Im(Y32)



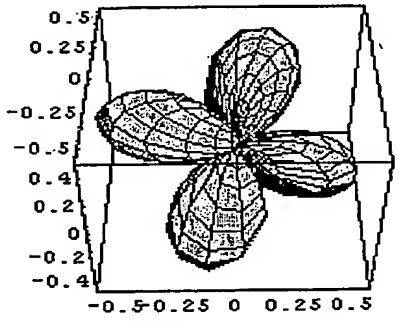
$Re(Y_{22})$



Y01 + Im(Y32)



$Re(Y_{22}) + Im(Y_{32})$



$Re(Y_{21}) + Im(Y_{21}) + Re(Y_{22})$

Figure 5

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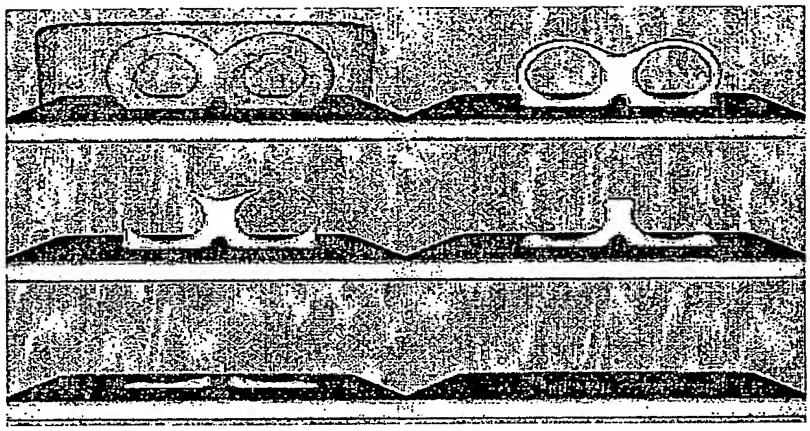

Figure 6

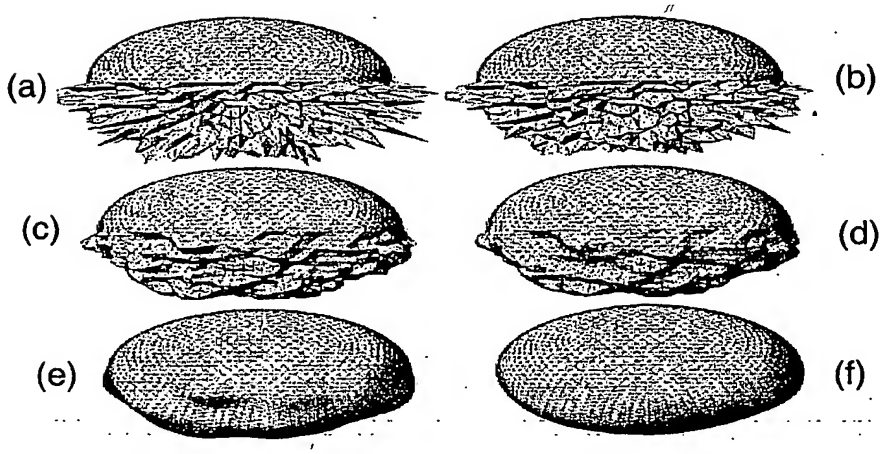

Figure 7

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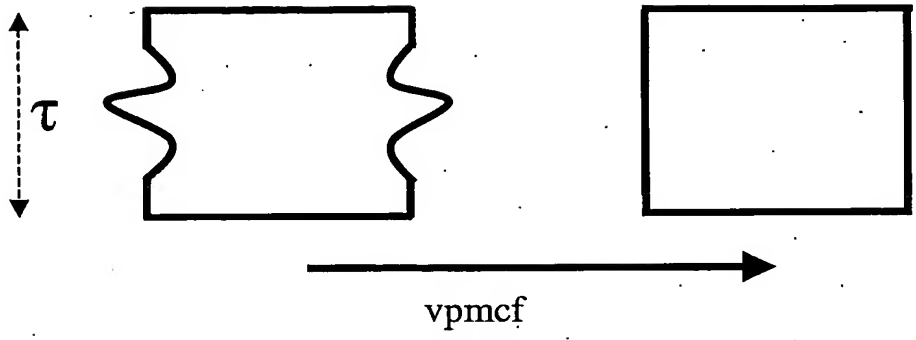

Figure 8

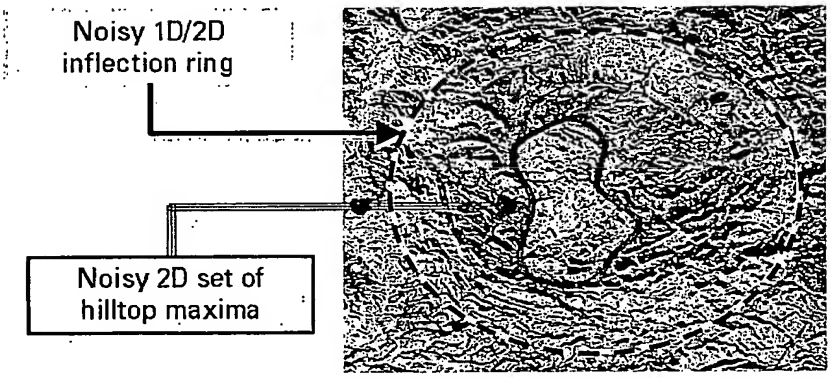

Figure 9

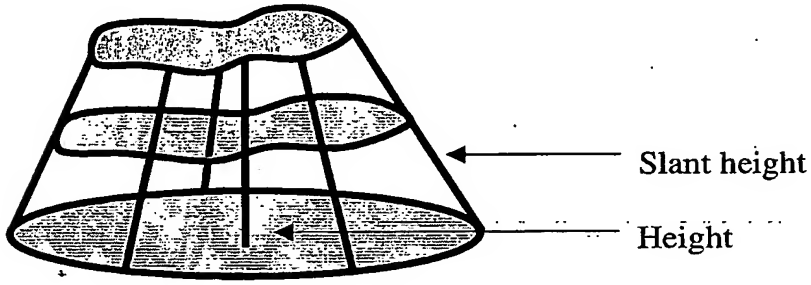

Figure 10

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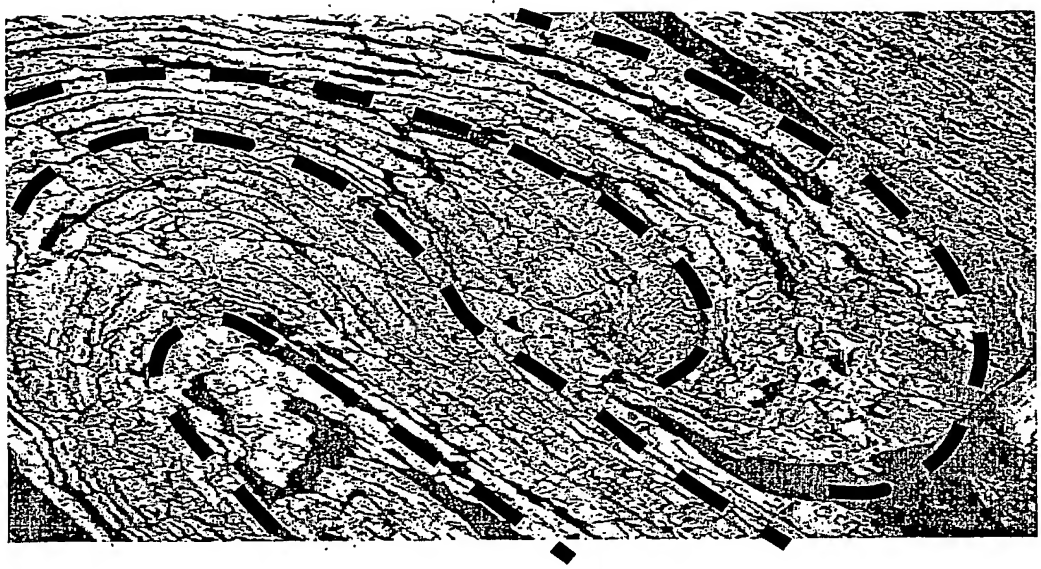

Figure 11

Figure 12

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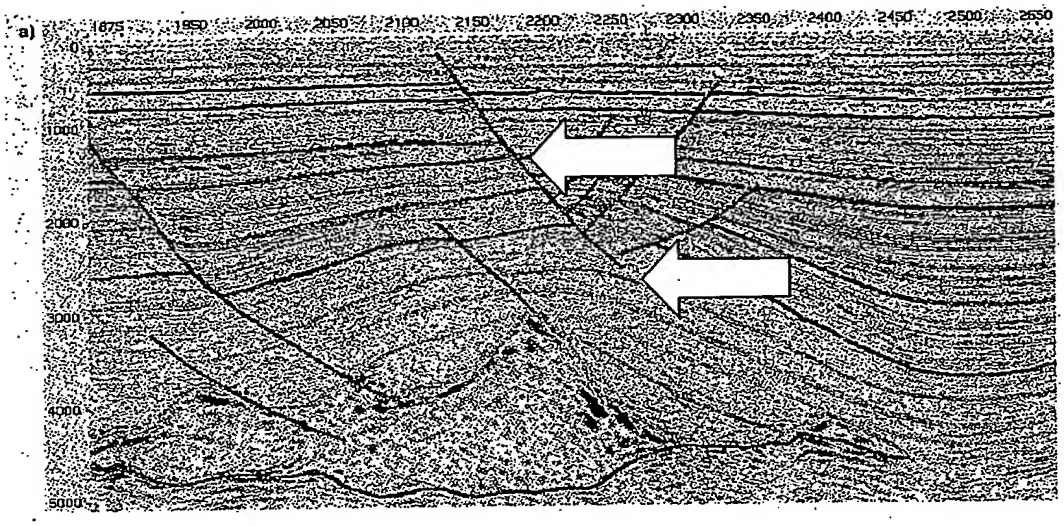


Figure 13

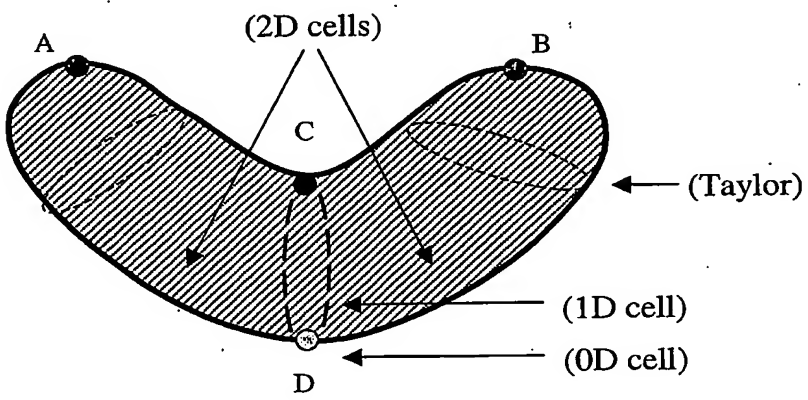
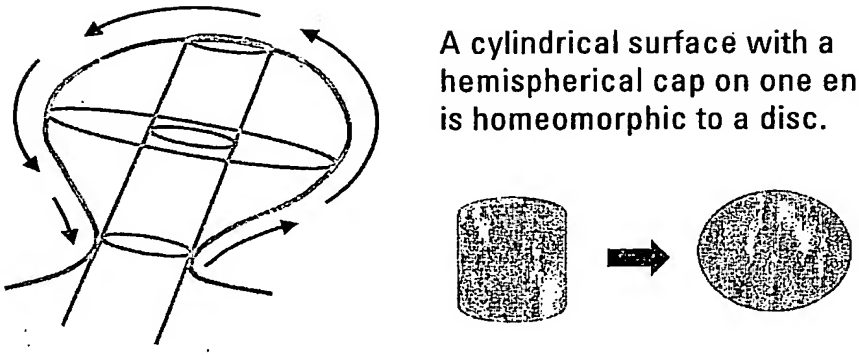


Figure 14



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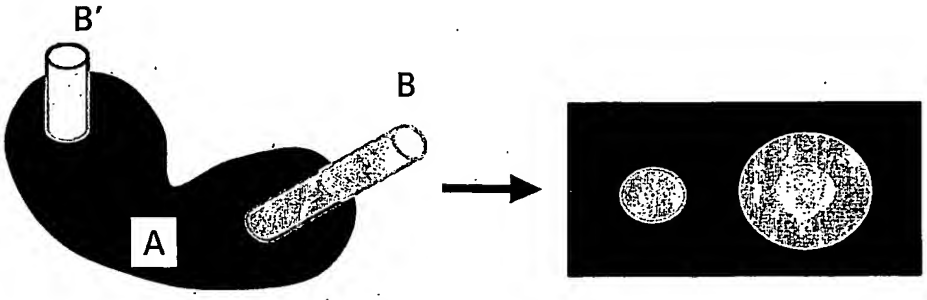

Figure 16

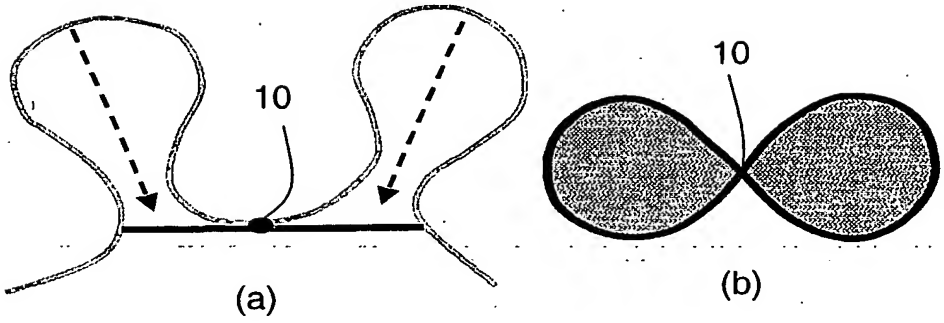

Figure 17

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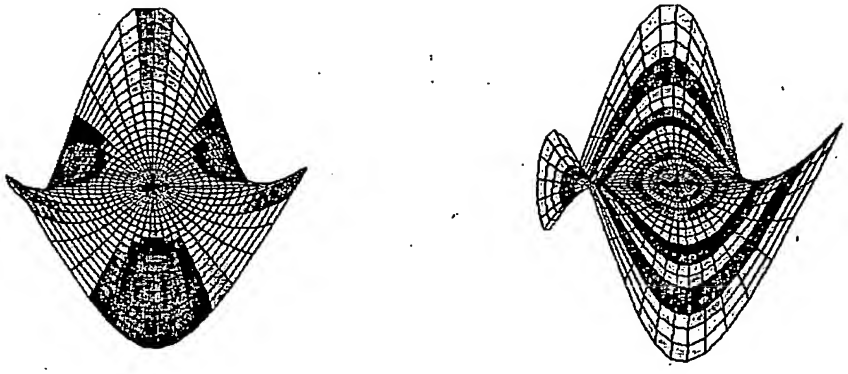
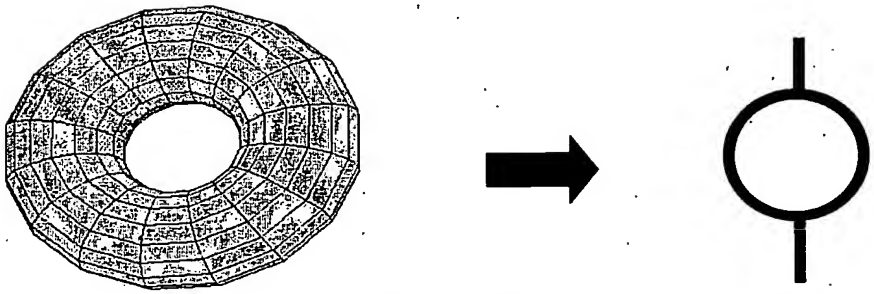


Figure 18



(a) Figure 19 (b)

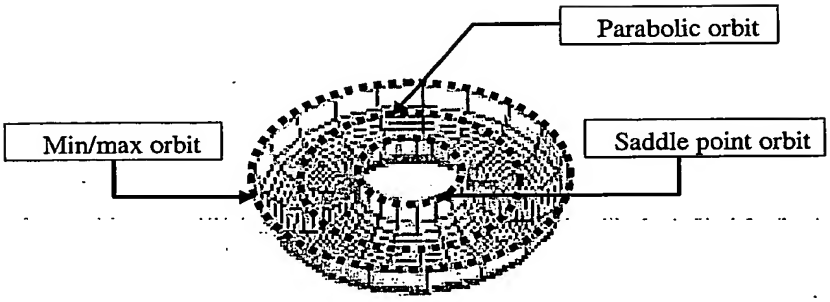


Figure 20

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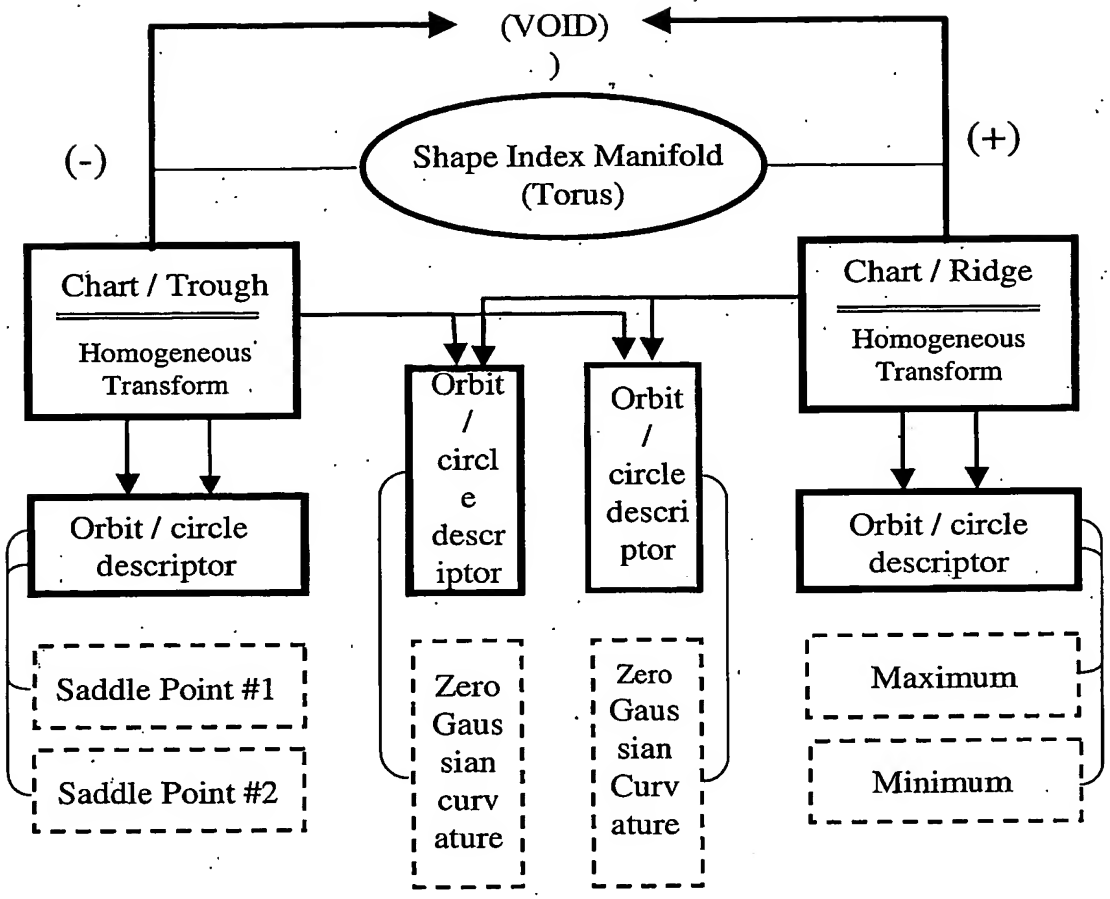

Figure 21

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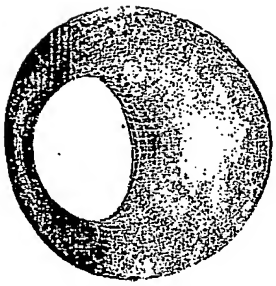

Figure 22

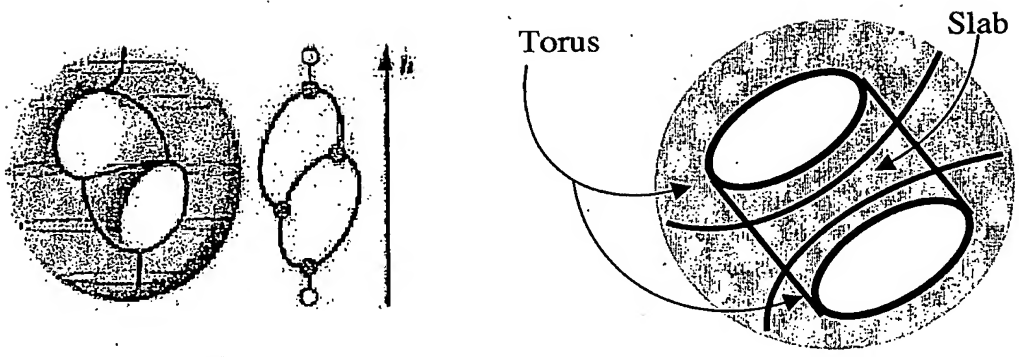

Figure 23

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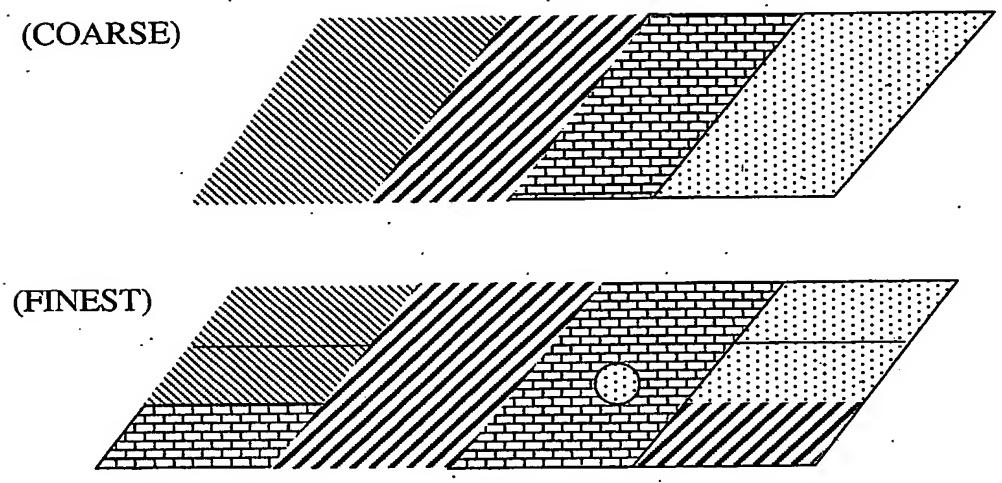

Figure 24

Stable shape index regions

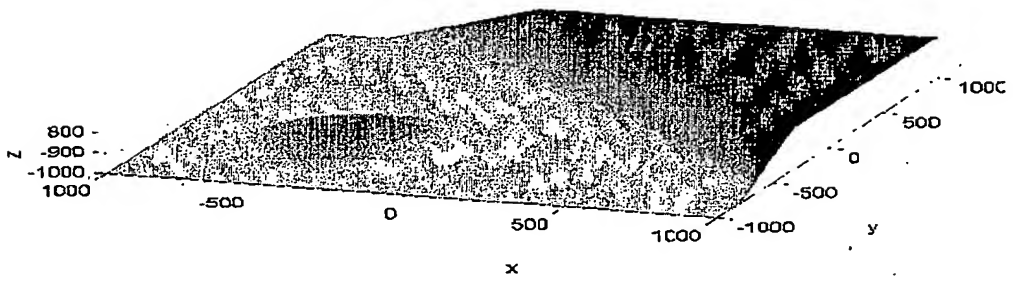

Figure 25

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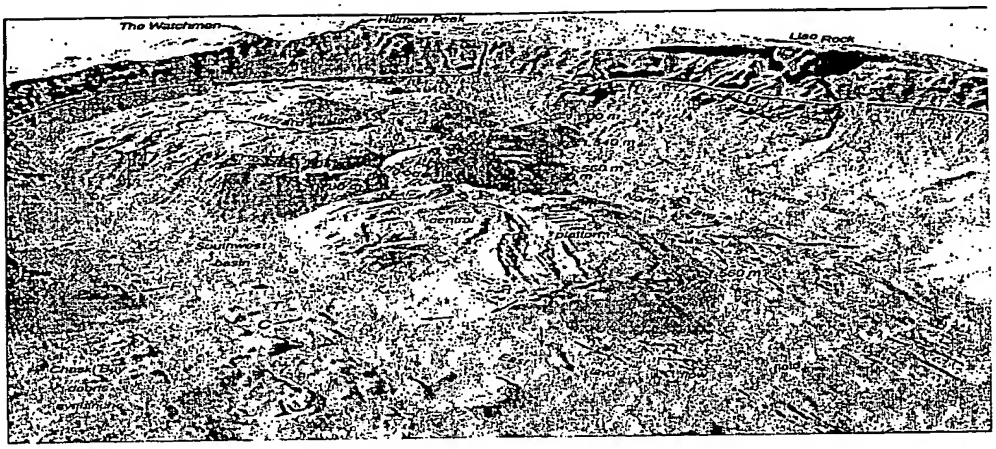

Figure 26

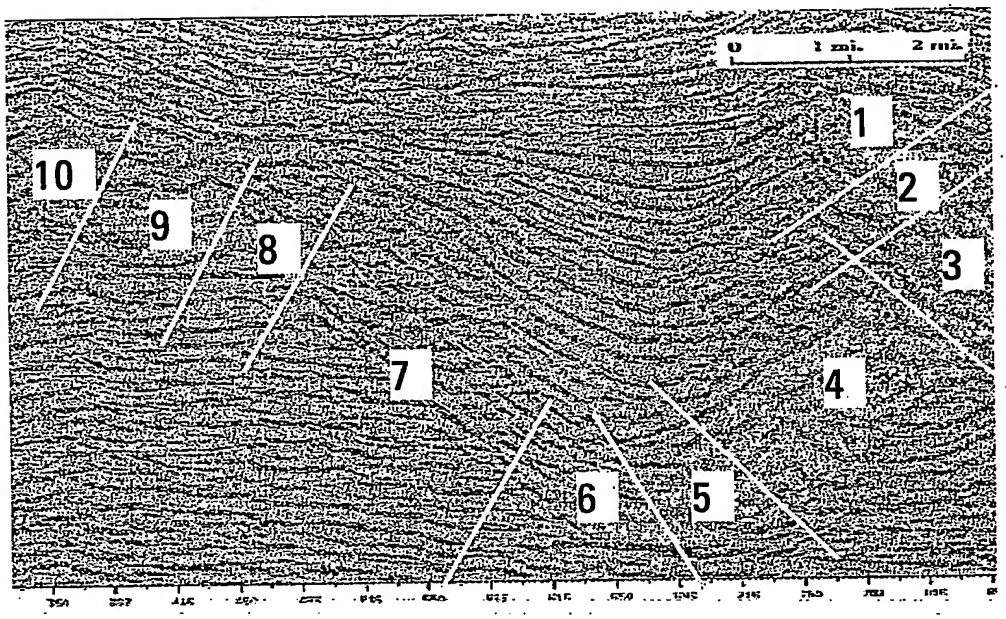

Figure 27

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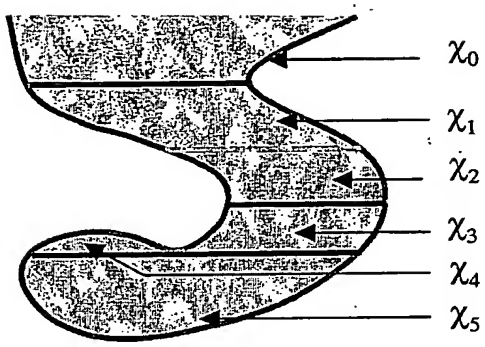

Figure 28a

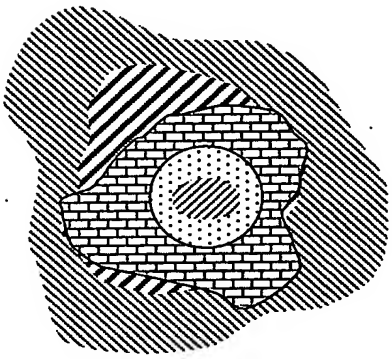

Figure 28b

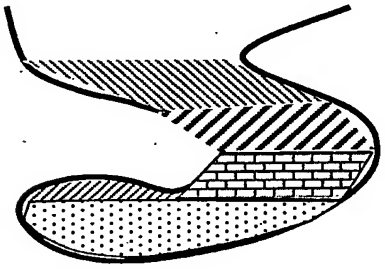

Figure 28c

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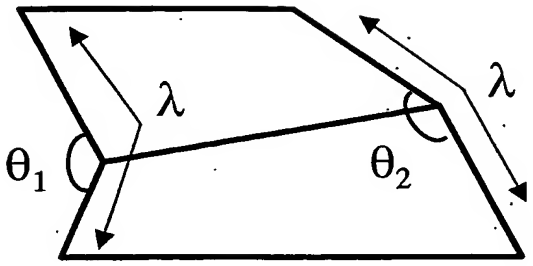


Figure 29a

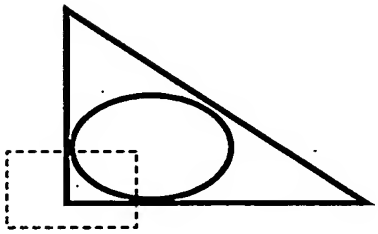


Figure 29b

$$Squeeze = \begin{pmatrix} \sin\vartheta & 0 \\ \cos\vartheta & 1 \end{pmatrix}, \; where \; 0 \le \vartheta < \pi,$$

$$Stretch = \begin{pmatrix} \sigma_x & 0 \\ 0 & \sigma_y \end{pmatrix}, \; where \; \sigma_x, \sigma_y > 0,$$

$$Blend = Stretch * Squeeze = \begin{pmatrix} \sigma_x \sin\vartheta & 0 \\ \sigma_y \cos\vartheta & \sigma_y \end{pmatrix}.$$

Figure 29c

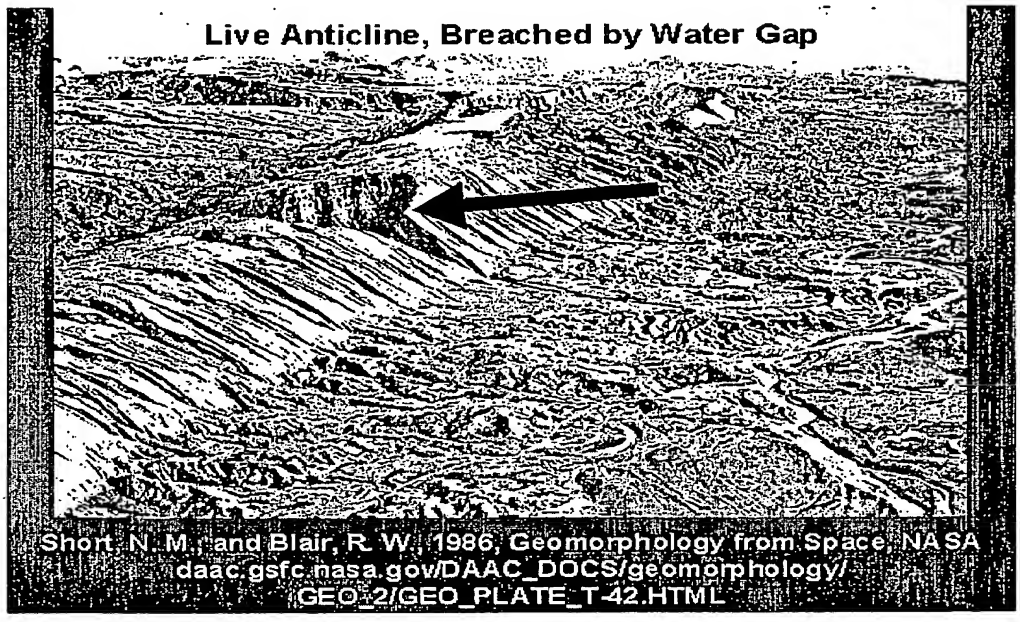


Figure 30

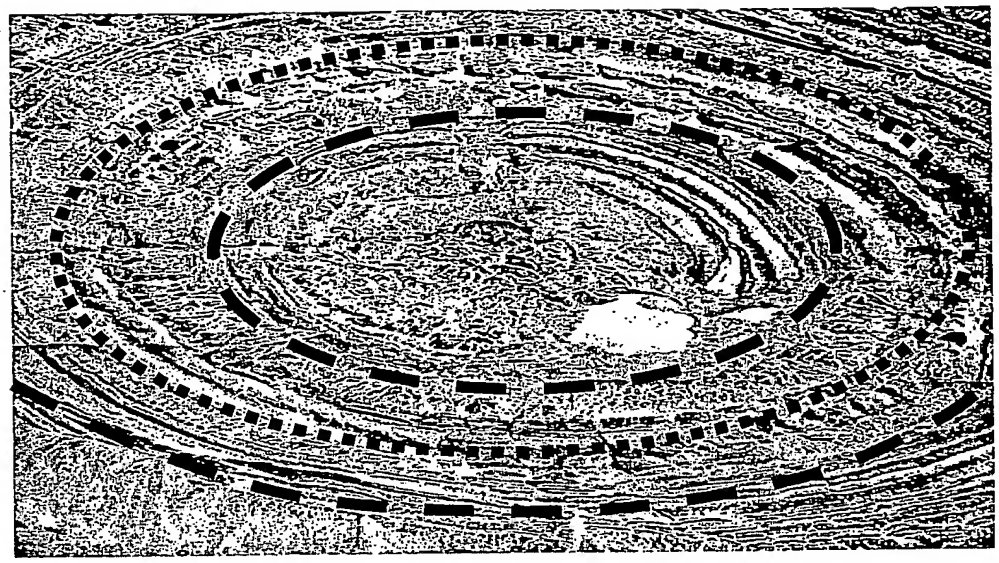


Figure 31

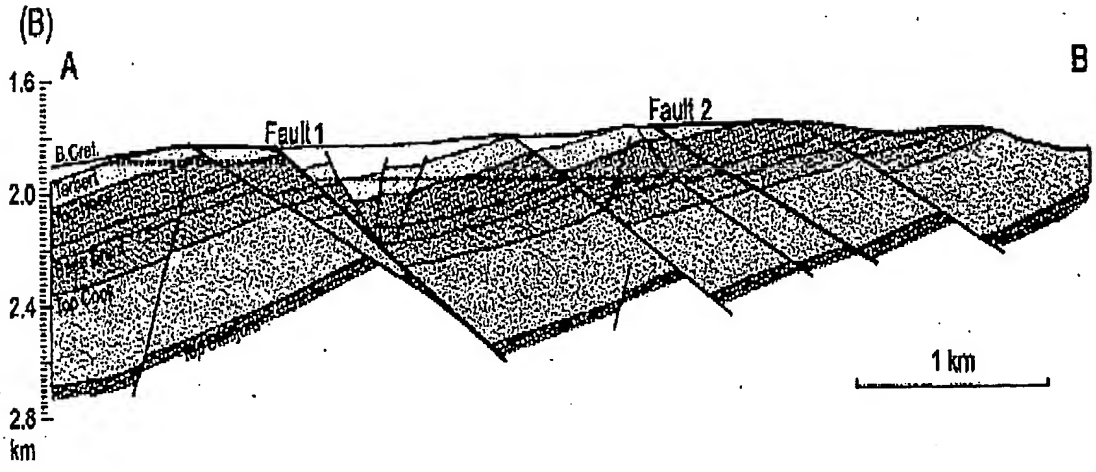


Figure 32

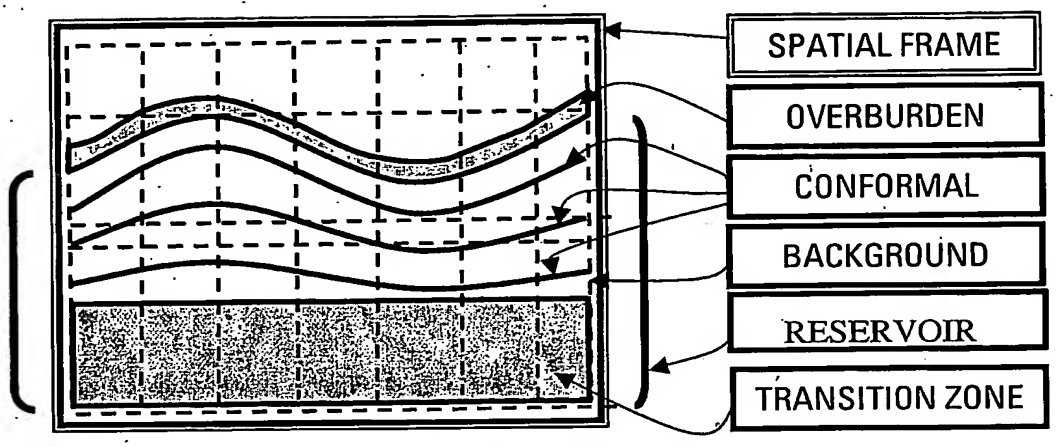


Figure 33

Figure 34

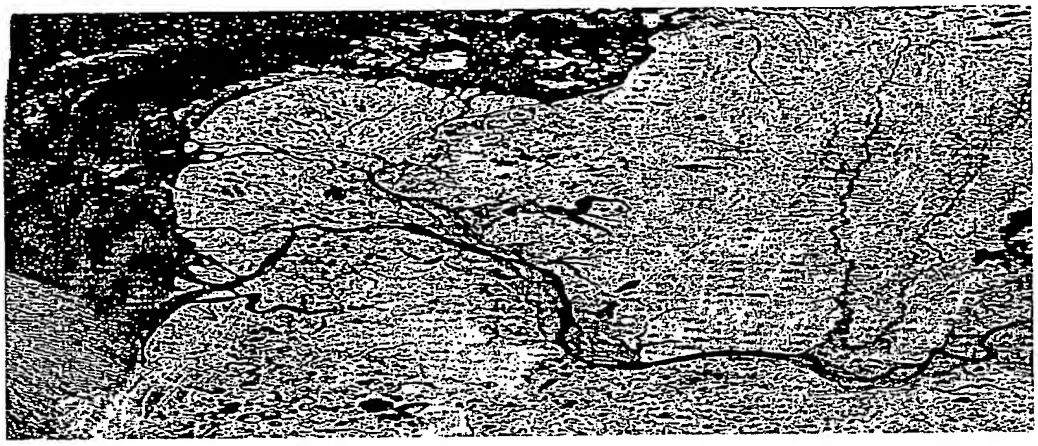
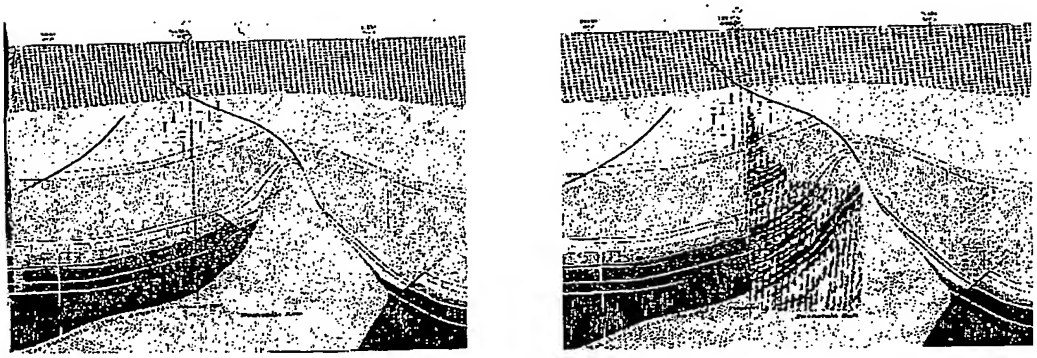


Figure 35



(a) (b)

Figure 36

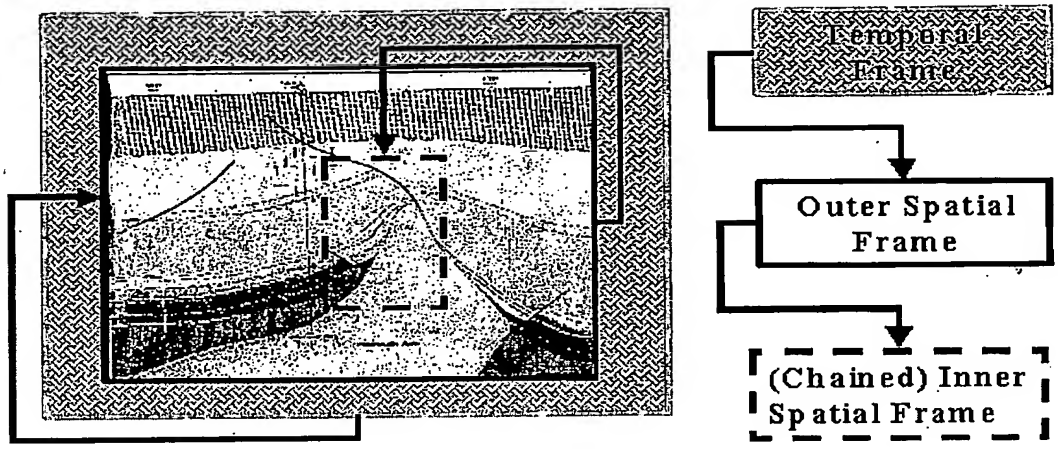


Figure 37

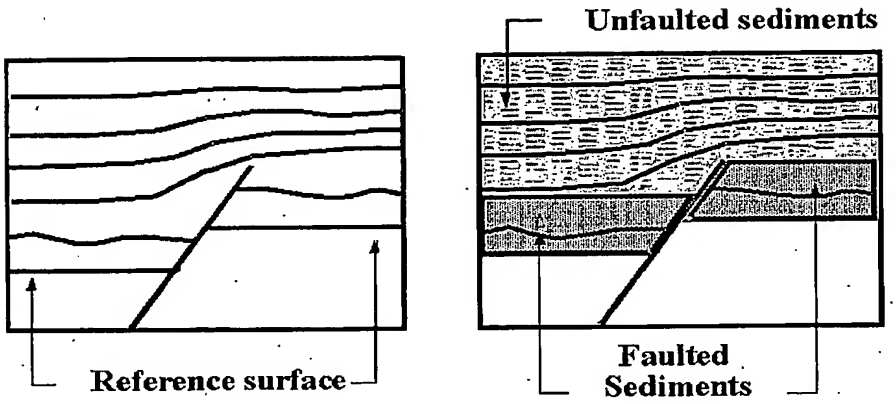


Figure 38

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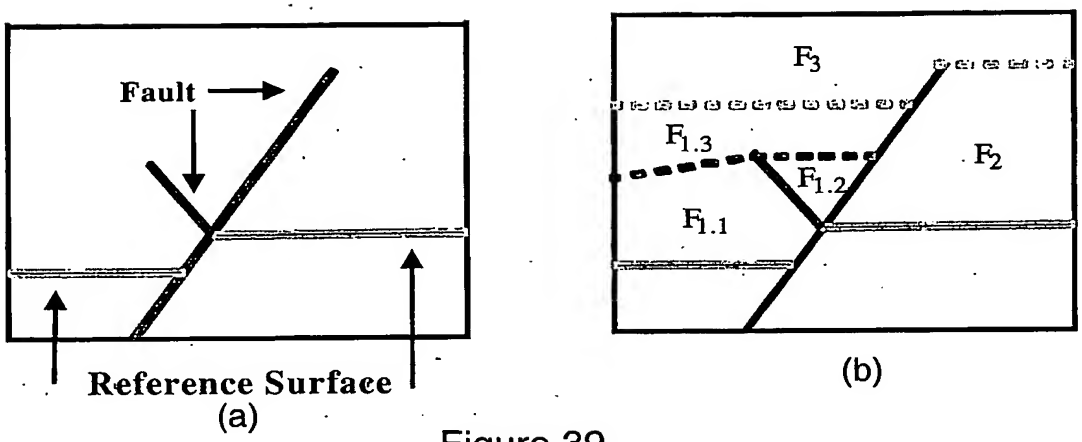

Figure 39

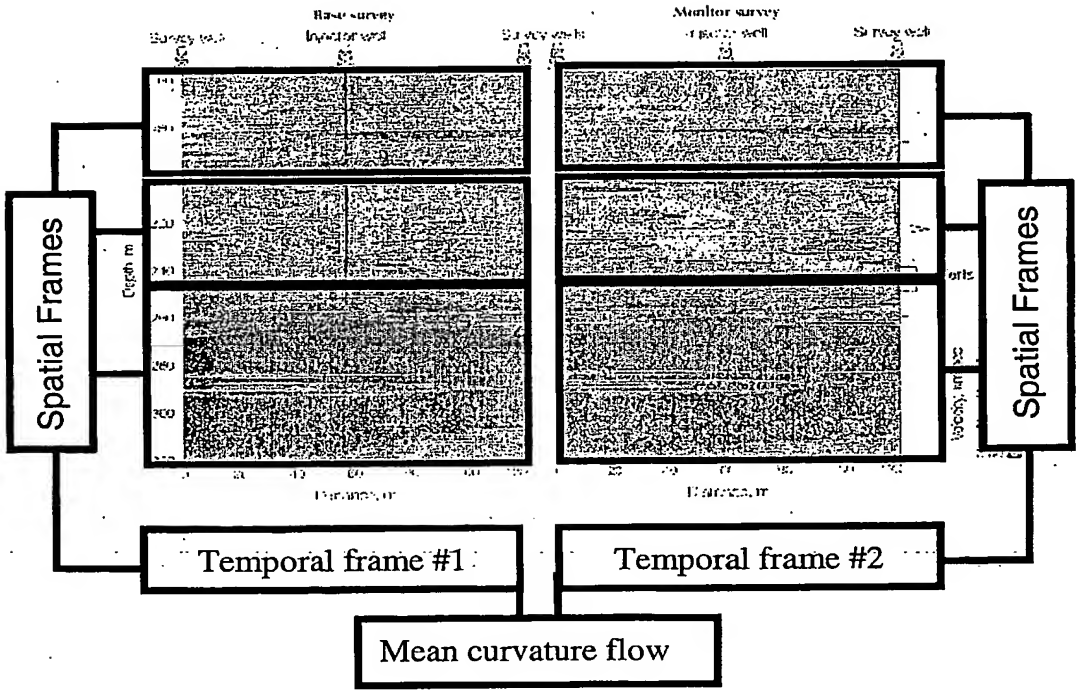

Figure 40

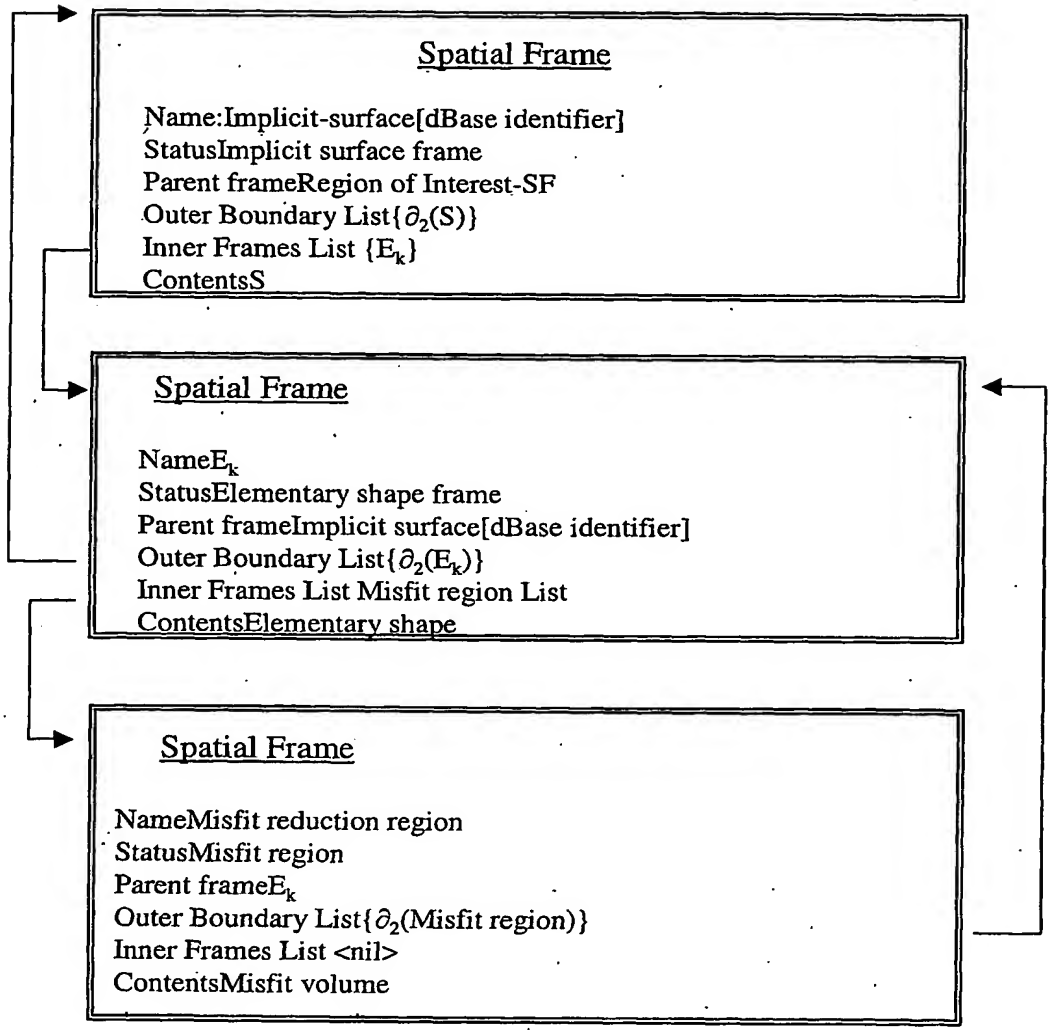
Spatial Frame
Name:Implicit-surface[dBase identifier]
StatusImplicit surface frame
Parent frameRegion of Interest-SF
Outer Boundary List{$\partial_2(S)$}
Inner Frames List {E_k}
ContentsS
Spatial Frame
NameE_k
StatusElementary shape frame
Parent frameImplicit surface[dBase identifier]
Outer Boundary List{$\partial_2(E_k)$}
Inner Frames List Misfit region List
ContentsElementary shape
Spatial Frame
NameMisfit reduction region
StatusMisfit region
Parent frameE_k
Outer Boundary List{∂_2(Misfit region)}
Inner Frames List <nil>
ContentsMisfit volume

Figure 41

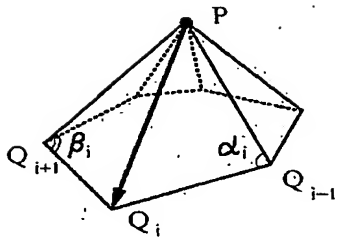

Figure 42

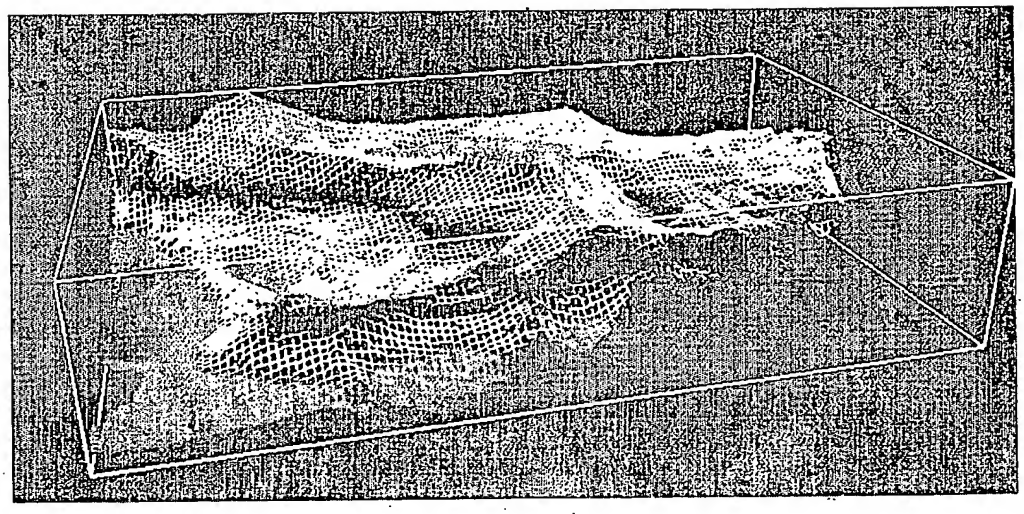

Figure 43

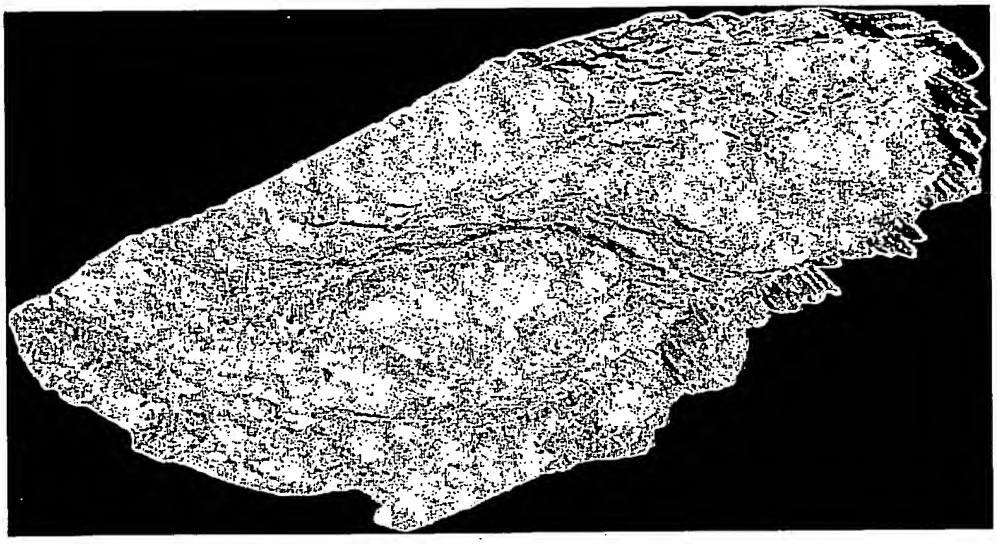

Figure 44

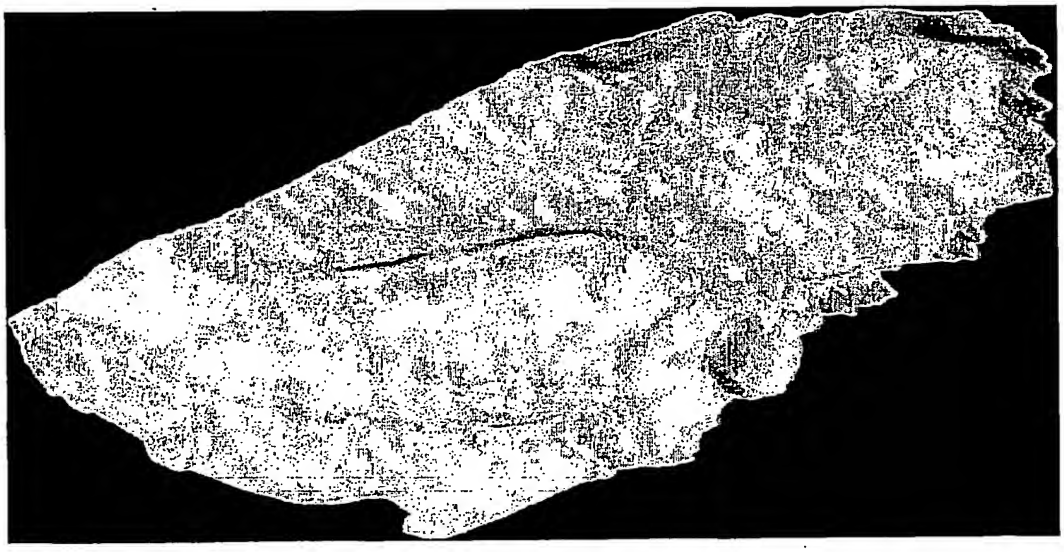

Figure 45

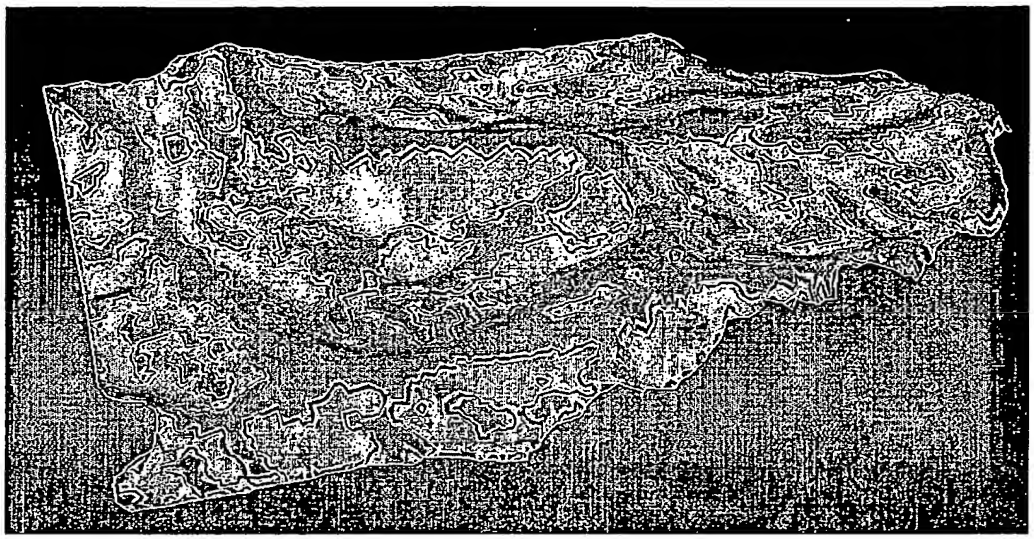

Figure 46

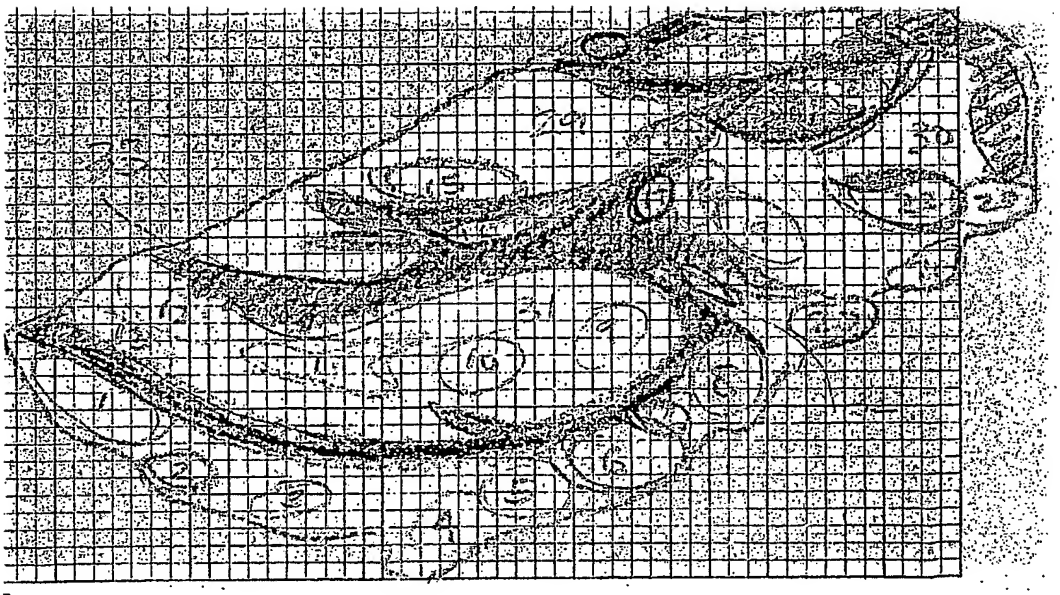

Figure 47

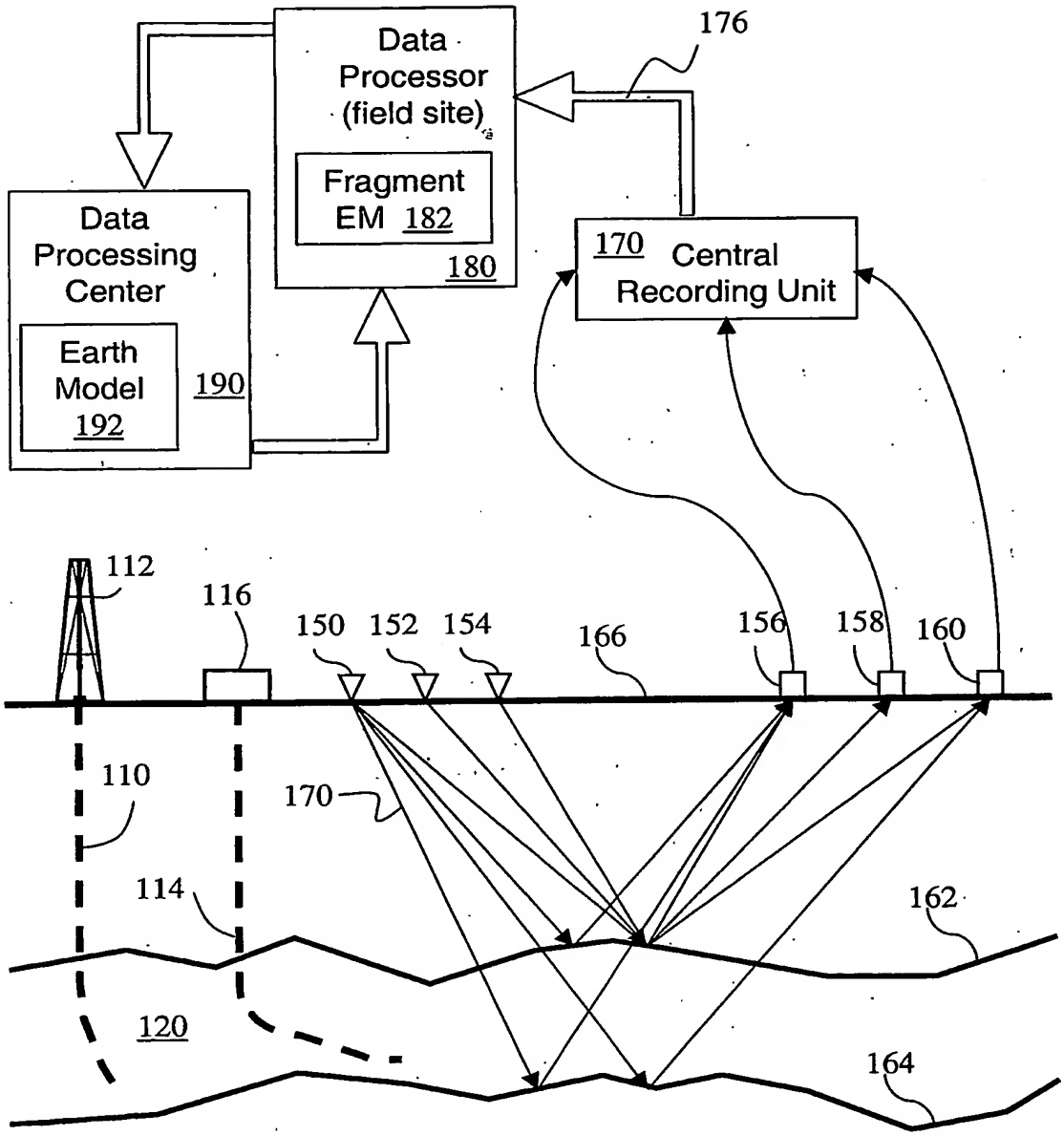
Data Processor (field site)
Fragment EM 182
180
176
Data Processing Center
Earth Model 192
190
170 Central Recording Unit
112
116
150
152
154
166
156
158
160
110
170
114
162
120
164

Figure 48

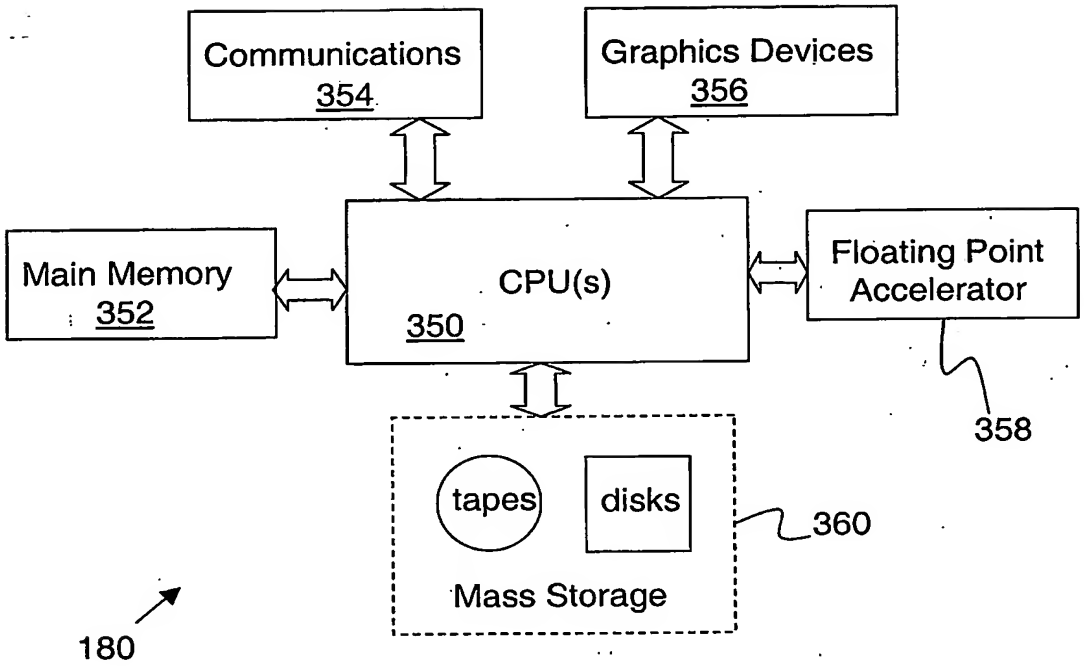
Communications
354
Graphics Devices
356
Main Memory
352
CPU(s)
350
Floating Point
Accelerator
358
tapes
disks
360
Mass Storage
180

Figure 49

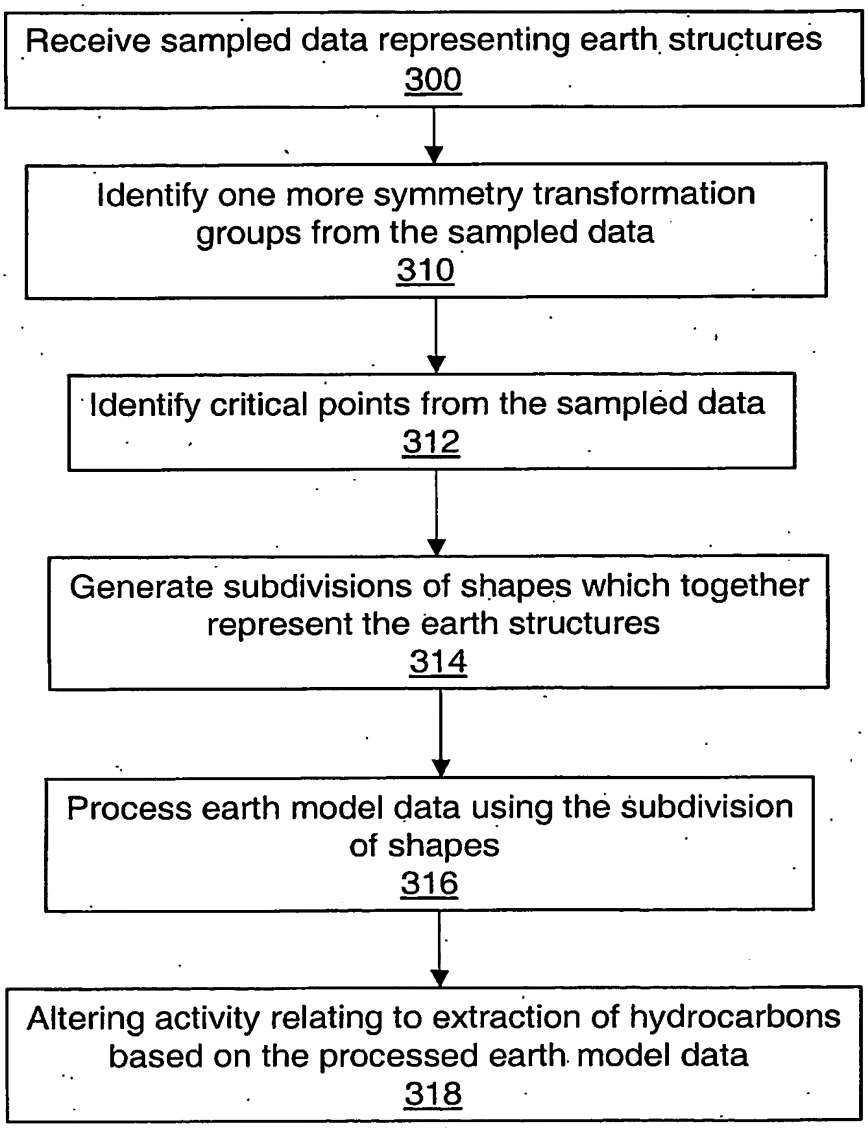
Receive sampled data representing earth structures
300
Identify one more symmetry transformation groups from the sampled data
310
Identify critical points from the sampled data
312
Generate subdivisions of shapes which together represent the earth structures
314
Process earth model data using the subdivision of shapes
316
Altering activity relating to extraction of hydrocarbons based on the processed earth model data
318

Figure 50

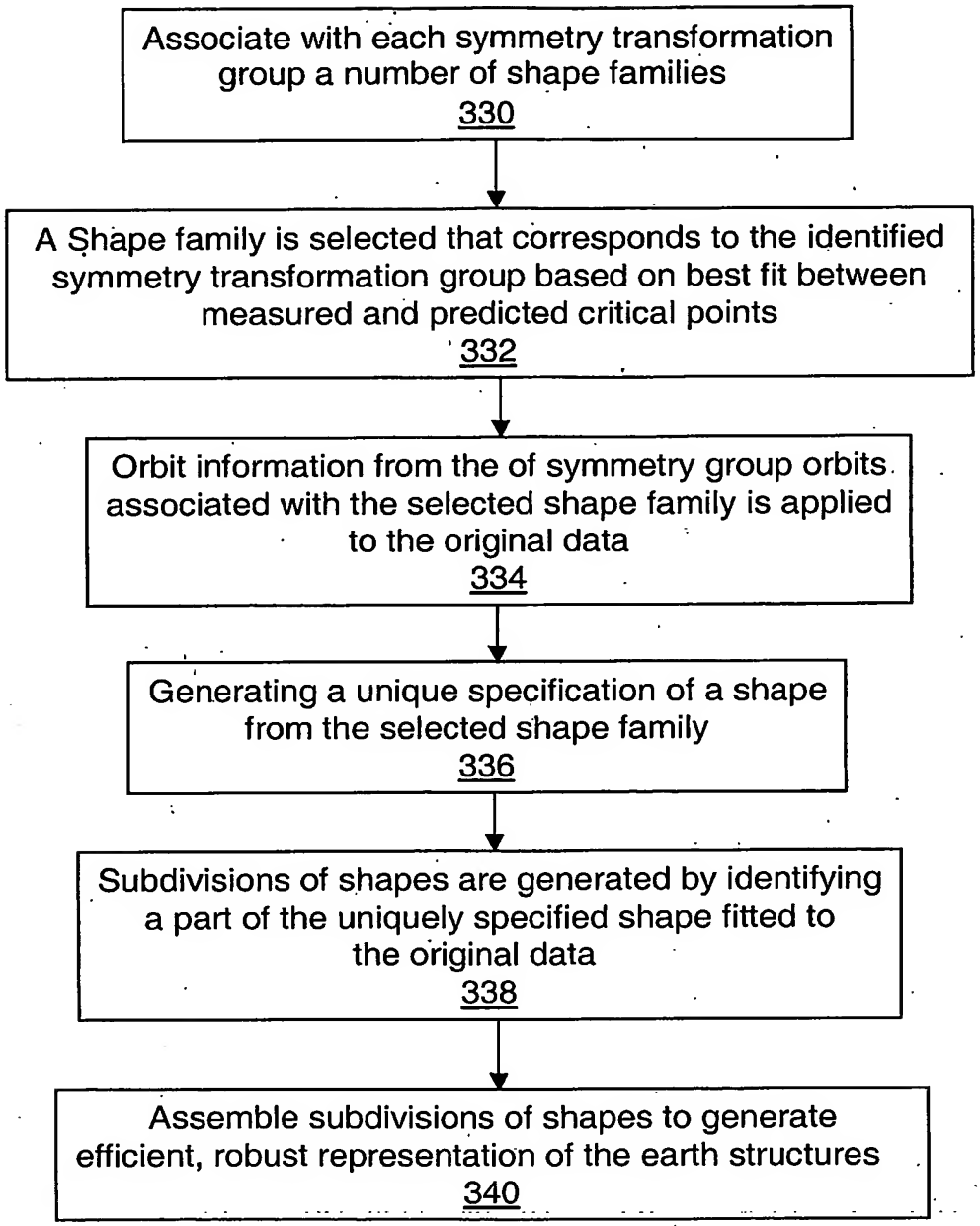
Associate with each symmetry transformation group a number of shape families
330
A Shape family is selected that corresponds to the identified symmetry transformation group based on best fit between measured and predicted critical points
332
Orbit information from the of symmetry group orbits associated with the selected shape family is applied to the original data
334
Generating a unique specification of a shape from the selected shape family
336
Subdivisions of shapes are generated by identifying a part of the uniquely specified shape fitted to the original data
338
Assemble subdivisions of shapes to generate efficient, robust representation of the earth structures
340

Figure 51